CHARACTERS AND RELATIONSHIPS OF THE MESOZOIC PELECYPOD *PSEUDAVICULA*

by J. M. DICKINS

ABSTRACT. The hinge structure and the musculature are described and illustrated. An anterior ear and a subauricular notch are present in right valves, the ligament is of the 'pteriid' type with a chrondophore, and the musculature is similar to that of *Chlamys*. The main shell layer is composed of concentric interlocking lamellae and the valves although inequal are biconvex. It is concluded that *Pseudavicula* is a pectinoid and appears to be most closely related to forms placed in the subfamily Streblochondriinae of the family Aviculopectinidae.

WHEN Etheridge jun. proposed the generic name *Pseudavicula* (1892, p. 449), with *Lucina anomala* Moore (1870, p. 251, pl. 14, fig. 4) as type, he gave the following diagnosis:

'Shell in general outline meleagriniform, but devoid of an anterior wing or ear. Valves compressed, closed, nacreous within, bi-convex, inequilateral. Cardinal margin thin, no area, or hinge teeth, but probably with a small ligament. Position wing moderately developed, but with little or no emargination. Adductor muscular scars subcentral, of medium size.'

The name *Pseudavicula* was apparently first published by Hudleston (1890, p. 244). It is clear from Hudleston's paper, however, that the name was derived from Etheridge's work and he states 'the diagnosis of *Pseudavicula* is not known to me'. He referred his specimens to *Pseudavicula anomala* (Moore) 1870 and placed *Avicula orbicularis* Hudleston 1884 in synonymy with *P. anomala*. Hudleston's use of the name thus does not effect the choice of type species.

In *Pseudavicula*, Etheridge placed two closely related species *Lucina anomala* Moore and *Lucina? australis* Moore (1870, p. 251, pl. 14, fig. 5). He also doubtfully referred *Avicula alata* Etheridge sen. (1872, p. 342, pl. 20, fig. 8) to this genus (p. 563). In 1907 he added, from Queensland, another species, *P. papyracea* Etheridge jun. (1907, p. 319).

In describing specimens from South Australia, Whitehouse (1925, pp. 27, 28) suggested that *P. australis* was a synonym of *P. anomala* and that the right valve of his specimens had no byssal sinus. He also showed that a 'pteriid' type of hinge was present (p. 28, pl. 1, figs. 2, 3) although this does not seem to have become widely known.

The three species, referred without doubt by Etheridge to *Pseudavicula*, form a distinctive closely related group in the Roma 'Formation' of Aptian age, and are widespread in Queensland, New South Wales, and South Australia, occurring sometimes in large numbers. *P. papyracea* has also been recorded by Glaessner (1945, p. 159, pl. 6, fig. 11; 1958, p. 201) from New Guinea, and I have found *P. papyracea* or a closely related species in the Canning Basin of Western Australia in deposits which are thus no doubt of Cretaceous age (Frezier Sandstone of Lindner and Drew: see McWhae, Playford, Lindner, Glenister, and Balme 1958, p. 108). The anterior ear and subauricular notch are also shown in right valves of these specimens.

The following features are revealed by a study of specimens in the collections of the

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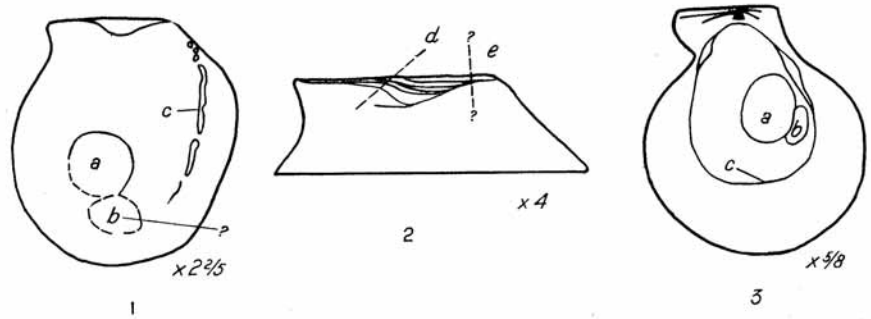
Geological Survey of Queensland and afford additional information on the character and relationship of the genus.

Structure of hinge and cardinal region. The characters of *Pseudavicula* are shown excellently in internal and external impressions from the south-west corner of Portion 53V, Parish of Bendemere, left bank of Yuelba (or Yuleba) Creek, Queensland. (Yuelba Creek is about 36 miles east of the township of Roma.) All the right valves appear to be smooth but the left valves apparently may be smooth or have delicate radial ribbing. A left valve showing radial ribbing is figured in the accompanying plate. According to Etheridge (1907, p. 326), *P. papyracea* is separable from *P. anomala* by the absence of radial ribbing so that, in this case, it is difficult to decide what species are present—apart from the radial ribbing the specimens do not appear to differ significantly.



TEXT-FIG. 1, Internal impression of a right valve of *Pseudavicula*. 2, Impression of ligament of *Pseudavicula*. 3, Musculature of a right valve of *Chlamys islandicus* (based on Newell 1938). *a*, *b*, adductor impressions; *c*, pallial line; *d*, line of posterior edge of chondrophore; *e*, line of anterior edge of chondrophore.

The umbo is almost but not quite terminal, and a small anterior ear is visible in several right valves, one of which is figured. The anterior ear is relatively very small and would easily be lost by abrasion before burial or by erosion or breakage during weathering or during breaking out from the rock. This no doubt explains why the ear has not previously been recorded. The ear is separated below from the rest of the shell by a small but distinct subauricular notch (the term 'subauricular notch', used by Cox 1943, p. 153, is preferred to the perhaps misleading term 'byssal notch'). Except in distorted specimens the anterior ear is in the same general line as the rest of the cardinal margin.

The structure of the ligament is of the 'pteriid' type, characteristic of the aviculopectinids and the living pteriids. The ligament is lodged on a flattish ligament area; behind the umbo the area thickens and deepens to form a chondrophore or resilium pit. The chondrophore is marked off at the back by a distinct but rounded oblique boundary, the upper part of which points to the front. The anterior boundary is not clear in any of the specimens but appears to be more upright than the posterior boundary and situated level with the umbo. The area has parallel-longitudinal growth-lines and lacks any longitudinal ligament grooves. The structure is different from that found in

Deltopecten, where no chondrophore boundary is present, and is distinct from the leiopteriids where distinct longitudinal or chevron-shaped ligament grooves are present.

Musculature. The musculature of the right valve is shown in the accompanying text-figure, where a right valve of *Chlamys* is also illustrated. The right valve of *Pinctada* has been figured in the preceding paper on *Merismopteria*. An important feature of *Pseudavicula* is the closer resemblance to *Chlamys* than to *Pinctada*: that is, it is more closely related to the Pectinacea than to the Pteriacea.

Convexity of valves and shell structure. Etheridge (1907, p. 319) discussed the question of relative convexity of the right and left valve and concluded that in all three species, the left valve is more convex and the umbo higher than in the right. An examination of the collections in the Geological Survey of Queensland confirms Etheridge's conclusion. Although both valves are convex, in all specimens examined the left valve was more convex than the right. The inequality, however, varies considerably.

The specimen figured by Etheridge (1892, pl. 21, fig. 14) which was later the only specimen referred by him to *Pseudavicula papyracea* (1907, p. 319), and which must thus become the holotype, is preserved in the Geological Survey of Queensland. The specimen is exfoliated but shows a layer of concentric interlocking lamellae, such as Newell (1938) has shown to occur in *Aviculopecten* and Ichikawa (1958) has recently shown to occur in *Meleagrinella* and *Oxytoma*. The specimen figured by Etheridge (1892, pl. 21, fig. 16), which in my opinion is also referable to *P. papyracea*, also shows concentric interlocking lamellae, which are just visible to the naked eye.

Relationships of Pseudavicula. The small anterior ear and especially the subauricular notch in *Pseudavicula*, together with other characters, suggest derivation from members either of the Pectinacea or the Pteriacea in which the anterior ear and subauricular notch were more strongly developed. In considering whether *Pseudavicula* belongs to the Pectinacea or to the Pteriacea, the musculature and the shell structure are of significance, as the type of hinge present occurs in both superfamilies. Each definitely indicates relationship to the Pectinacea. The muscle pattern is of the 'pectinoid' type; the shell

EXPLANATION OF PLATE 63

Figs. 1–5. *Pseudavicula* cf. *papyracea* Etheridge jun. 1907. Specimens from south-west corner of Portion 53V Parish of Bendemere, left bank of Yuelba Creek, about 36 miles east of Roma. The numbers are those of the Geological Survey of Queensland. 1, Latex impression of a left valve, ×2, No. F. 2317. 2, Latex impression of right valve showing anterior ear, ×2, No. F. 2316, dorso-lateral view. 3, Same, lateral view, ×2. 4, Internal impression of dorsal part of a right valve, ×4, No. F. 2315. 5, Complete view of same shell, ×2.

Figs. 6–12. *Merismopteria sp.* All specimens are from rocks of Permian age. 6–8, British Museum (Natural History) No. PL2865, 'Carboniferous', Australia. 6, Plasticene impression to show cardinal teeth, ×2. 7, Normal view, ×1. 8, Specimen tilted up at front to show muscle growth-lines, ×2. 9–10, British Museum (Natural History) No. PL2866, 'Carboniferous', Australia. 9, Normal view, ×1. 10, Dorsal view of right valve, ×1. 11, British Museum (Natural History) No. PL541, McCallum's Block, Bowen Coal Field, lateral view of left valve, ×½. 12, Commonwealth Palaeontological Collection Type No. 107, Field No. JB35, east end of Steamer's Beach, Jervis Bay, New South Wales, from beds probably equivalent to the Conjola Beds of David and Stonier. Internal impression of right valve showing longitudinal ligament grooves and a posterior lateral tooth, ×2; the front part of the shell is missing.

structure is characteristic of that found in the aviculopectinids and distinctly different from that found in the pterioids where, characteristically, a prominent prismatic layer is developed in each valve and the lamellar structure is absent. In the Upper Palaeozoic the biconvex Streblochondriinae of Newell (1938) appear likely to be ancestral to *Pseudavicula*.

In the Jurassic the biconvex *Pseudomonotis laevis* (Blake and Hudleston) Arkell (1931, p. 200, pl. 24, figs. 11, 11*a*, 12) appears to be closely related to *Pseudavicula* and may even be referable to this genus. In the Cretaceous *Pseudomonotis superstes* Spitz (1914, p. 201, pl. 18, figs. 6, 7) from the Gieumal Sandstone of the Himalayas appears to be closer to *Meleagrinella* Whitfield 1885 than to *Pseudavicula* unless two species are present among Spitz's specimens.

Conclusion. The present evidence supports a previous suggestion, based on a study of Permian forms, that a number of Mesozoic genera which have usually been placed by previous authors in the Pteriidae are descended from the aviculopectinids (Dickins 1957, p. 44). Ichikawa (1958) has independently arrived at a similar conclusion, which he supports with ample and convincing evidence. Ichikawa (1958, p. 193) also agrees with Newell (1938) in considering the Aviculopectinidae are better placed with the pectinoids than with the pterioids. The author has discussed evidence in the immediately preceding paper which suggests that by the end of the Carboniferous period the Pectinacea and the Pteriacea were already distinct groups, evolving separately, and thus would place the Aviculopectinidae and derived forms in the superfamily Pectinacea and separate them from forms placed in the Pteriacea.

It can be concluded that *Pseudavicula* is derived from aviculopectinid forms and is possibly close to forms placed by Newell in the subfamily Streblochondriinae.

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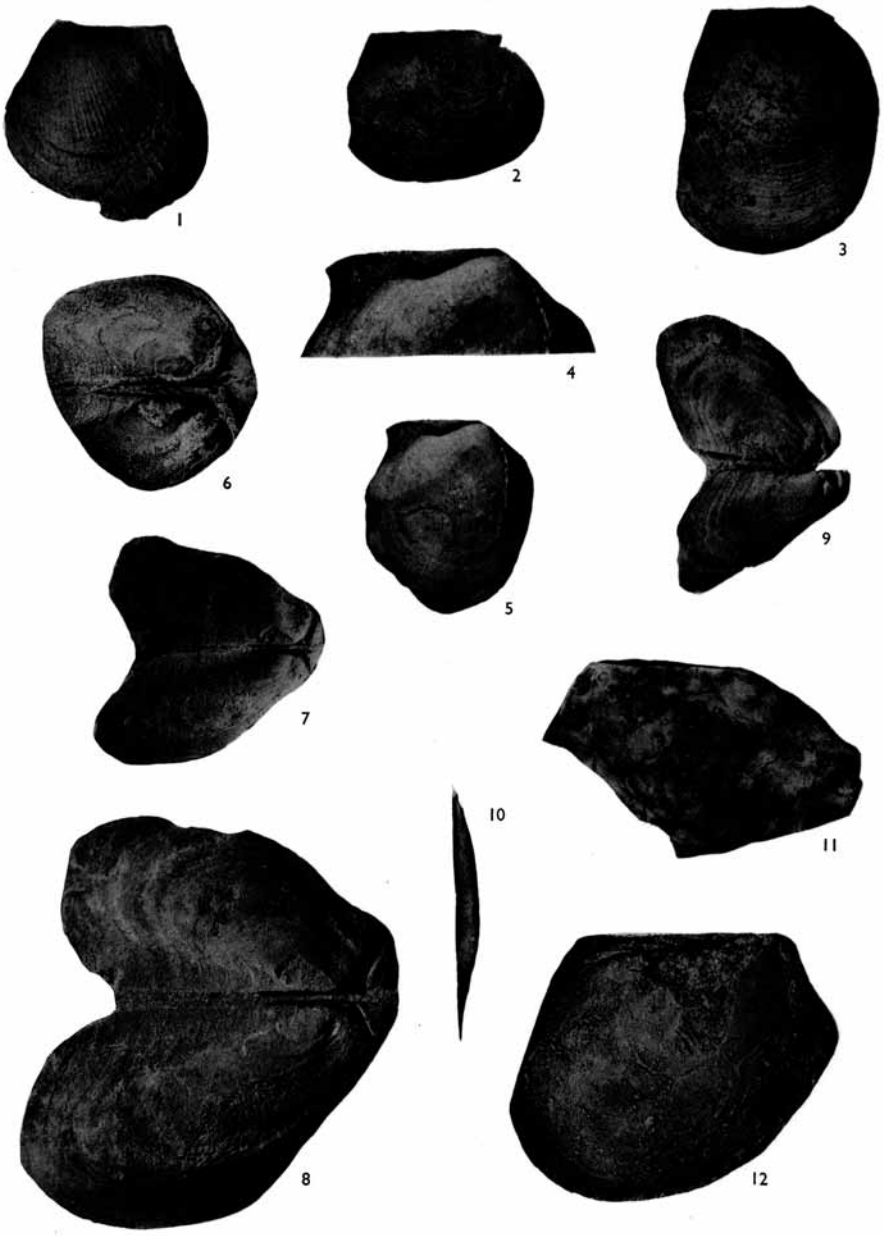

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